RELATION BETWEEN VISIBILITY RESTRICTIONS AND AUTO MISHAPS IN GREENSBORO, N. C.

By JOHN C. SCHOLL

[Weather Bureau, Raleigh, N. C., December 1934]

Careless and reckless driving, ignoring traffic rules and ordinances, mechanical defects in vehicles, excessive use of intoxicants, and numerous other reasons have been advanced as the chief causes of auto mishaps.

Little consideration seems to have been given to the possibility that visibility restrictions are either the direct or indirect cause of more wrecks than is generally conceded. The old saying, "The clearer the day the harder they hit", seems to have been almost universally accepted. It is the contention of the writer that many wrecks, which are attributed to other causes, are actually the result of

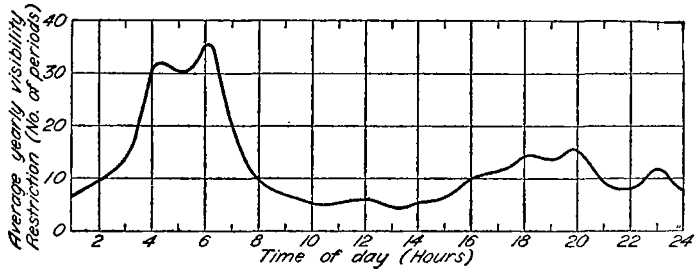

FIGURE 1.

lack of sufficient visibility to enable the driver to obtain a clear, unrestricted visualization of a situation in sufficient time to prevent a mishap—action taken in a split-second frequently causes or prevents mishaps. The present study of the relation between visibility restrictions and auto mishaps in the city of Greensboro, N. C., is based on a 4-year record, October 1930–September 1934, inclusive.

Figure 1 shows the frequency distribution of the periods of restricted visibility during the 4 years; abscissae are midpoints of the periods. In this study restricted visibility is defined as any condition under which the visibility is restricted to 6 miles or less—irrespective of the cause of the restriction. The expected peak at 6 a.m. is undoubtedly due to the "clustering" around this hour of that menace to transportation—fog.

During the period under consideration there were 2,113 auto mishaps in the city of Greensboro, an average of 1 wreck every 16.6 hours. During the periods of restricted visibility there was on the average of 1 wreck every 11.7 hours. During times of unrestricted visibility the average was 1 wreck every 18.3 hours. The difference is even more striking when it is remembered that a preponderance of the cases of restricted visibility are centered around a period of the day which is unquestionably one of relatively little traffic (figure 2). It therefore seems logical to assume that if the periods of restricted visibility were spread out more uniformly, instead of being clustered to such a marked extent around the hours of least traffic, then the difference in the numbers of wrecks during the hours of restricted and of unrestricted visibility would show even more convincingly that there are considerably more wrecks during times of restricted visibility.

It is significant (fig. 2) that the only instances in which line B is above line A are during those times in which visibility restrictions are most frequent (with minor exceptions during later hours of the day). Line B comes under line A about 6:40 a. m., and this is almost the identical time of the very noticeable decrease in visibility restrictions (fig. 1). It must be admitted, however, that there are certain other factors in regard to early morning driving which are favorable to mishaps; motorists are likely to be in a sleepy mood during this period of the day and less alert and active; but it does not seem that any reasonable allowance for these conditions would be sufficient to counteract, or even affect to any great extent, the above comparisons. The hour in which the greatest number of wrecks occur (8 p. m.) is one in which visibility restrictions are quite frequent.

It is admitted that this study shows no evidence of any relation between visibility restrictions and the secondary peak in line B, at 4 p. m. This rise at 4 p. m. is almost identical with the results of similar studies made in other cities. It has frequently been attributed to the circumstance that factories, schools, business houses, and offices usually close about this time of the day. This period consequently becomes one of heavy traffic; and the school children and workers who cause this additional traffic are in such a nervous and mental state that they, whether motorists or pedestrians, are more likely to cause auto mishaps.

Table 1 presents the number of hours of restricted visibility (X), and the number of auto mishaps during these hours (Y), for the period under consideration. These data give a correlation coefficient of +0.84. The

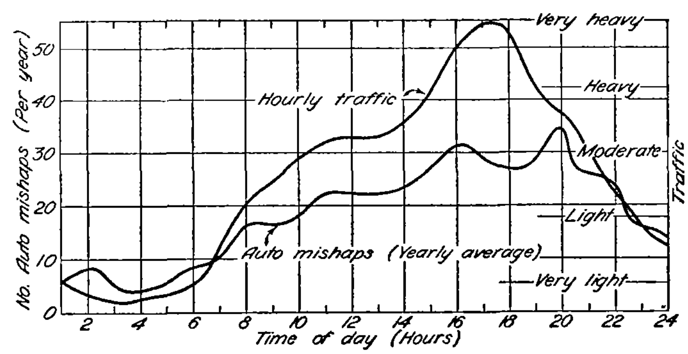

FIGURE 2.

necessary data for a multiple correlation, with the flow of traffic as another variable, could not be obtained.

The results of this study indicate that visibility restrictions are the actual cause of considerably more wrecks in Greensboro than is generally conceded:

(1) There is an increase of about 50 percent in the number of wrecks occurring during the times of restricted visibility as compared with periods of unrestricted visibility (based on actual records of the Greensboro Police Department and the U. S. Weather Bureau); as shown by figure 2, the ratio of wrecks to traffic is much higher

during the hours of restricted visibility (with a few minor exceptions).

(2) A surprisingly high correlation coefficient of +0.84 exists between the number of hours of restricted visibility and wrecks during these hours. It is realized that the proper interpretation of a correlation coefficient is one of the most difficult problems in the entire field of statistical analysis; however, it is generally accepted among statisticians that "coefficients above 0.70 give almost certain evidence of correlation, and any above 0.50 are ordinarily significant", and the above direct coefficient therefore indicates an actual correlation of the variables.

It therefore seems that visibility restrictions should be considered when studying the causes, and means of preventing, auto mishaps. It is the hope of the writer that this article will be of value in the fight being made by the press, civic clubs, and others to reduce the startling number of wrecks now occurring.

TABLE 1

	X	Y		X	Y
October 1930	170	21	November 1932	105	9
November 1930	199	26	December 1932	314	30
December 1930	147	17	January 1933	86	6
January 1931	109	5	February 1933	175	9
February 1931	147	16	March 1933	80	8
March 1931	139	9	April 1933	100	8
April 1931	151	15	May 1933	43	7
May 1931	89	13	June 1933	17	1
June 1931	27	1	July 1933	49	2
July 1931	37	3	August 1933	31	3
August 1931	71	7	September 1933	72	6
September 1931	19	3	October 1933	72	3
October 1931	98	7	November 1933	239	17
November 1931	385	21	December 1933	296	22
December 1931	222	16	January 1934	240	13
January 1932	183	30	February 1934	243	21
February 1932	205	18	March 1934	309	30
March 1932	181	11	April 1934	149	10
April 1932	121	7	May 1934	150	10
May 1932	138	6	June 1934	78	5
June 1932	62	9	July 1934	135	15
July 1932	24	1	August 1934	112	12
August 1932	16	5	September 1934	250	26
September 1932	84	5			
October 1932	128	12	Total	6, 506	557

WEATHER AND PEARS IN NEW YORK STATE

By W. A. MATTICE

[Weather Bureau, Washington, January 1935]

Since the locale of the heaviest pear production in New York is concentrated in the Hudson Valley and the western lake sections, a group of stations was chosen in this region in order to cover the territory adequately. The data for the previous year's meteorological data were taken from the Climatological Data of the Weather Bureau and represent averages for the entire State. The weekly data were computed for selected stations in the

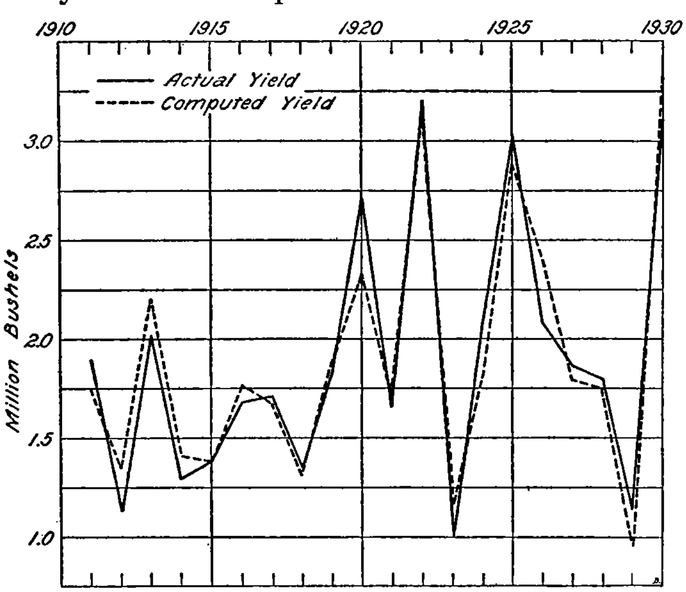

FIGURE 1.—Actual and computed production of pears in New York State.

areas of heaviest production, both regular Weather Bureau and cooperative stations. Sunshine data are for the regular Weather Bureau stations only.

The method used in computing the final correlation was that developed by Kincer [1] and scarcely needs further elaboration. The original single coefficients used in this study covered many phases of the weather, ranging from monthly mean temperatures for the State as a whole to weekly means of temperature, rainfall, and sunshine. Relative humidity was also used in the study, but no significant relationships were discovered. The total number of original coefficients was around 90, and out of this number 24 were selected as being of enough significance to use. The highest single coefficient used in the starting process was +0.59.

There are eight variables selected as the result of the trial computations, and the final multiple coefficient is +0.97. After the final computations of production by Kincer's method, a multiple coefficient was obtained following the method outlined by Wallace and Snedecor.[2] This gave the regression equation as follows:

$$X=57.95a+1.32b+13.74c-11.05d+9.35e+19.89f$$
$$+3.84g+1.84h-805.35$$

where X is the estimated yield and a is the weekly average rainfall for the week ending June 20; b is the weekly percent of possible sunshine for the week ending May 2; c is the State average rainfall for September of the preceding year; d is the monthly State rainfall for August of the preceding year; e is the monthly mean temperature for the State as a whole for June of the preceding year; f is the State average rainfall for May of the preceding year; g is the weekly mean temperature for the week ending March 14; and h is the weekly mean temperature for the week ending April 18.

Thus, the computations of production are all based on weather data well in advance of harvest. It is difficult to establish particular reasons for the significance of the various elements, except in a general way; for instance, the period of mean temperatures for the weeks of March 14 and April 18 may have some significance as regards blooming or setting. The rainfall of June 20 may be important as regards the sizing of the fruit. The previous year's data probably are significant as the fruit buds of the following year may depend largely on the weather when they are forming.

Figure 1 shows the actual and computed yields for the entire period, 1911–30. It will be seen readily that the weather is apparently a major factor as regards the production of pears. In the graph the last four ciphers of the production figures have been omitted for clarity in reproduction and also to facilitate computations in the actual work.

[1] Kincer, J. B., and Mattice, W. A. Statistical correlations of weather influence on crop yields. Mo. Wea. Rev., February 1928, vol. 56, p. 2.

[2] Wallace, H. A., and Snedecor, Geo. W. Correlation and machine calculation. Iowa State College, vol. 23, no. 35, Jan. 28, 1925.